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any direction under the conditions given, contain the vital elements.

As an explanation of soaring birds the facts of the transformation of gravity into air disturbance, and the results flowing therefrom as stated, are pertinent. To invalidate that explanation it must be shown :

1. That such transformation does not take place.
2. That no such results as those given are possible.

THE STONE AX IN VERMONT.[1]

BY PROFESSOR GEO. H. PERKINS.

II.—NOTCHED AND GROOVED AXES.

IN all our collections we find a few axes which are notched or grooved across the narrow sides. They are not common in any portion of Vermont, nor, if we may judge from what has been published by various writers, do they appear to be abundant anywhere in the United States.

As was noticed in the preceding article we are able to arrange our specimens in such a manner that there is a very complete series from the simplest celt, through the notched ax, to the fully grooved ax, and it seems quite probable that the notched ax was the second step in the development of the ax from the simply edged pebble. The form of the notched ax is more like that of the common celt than is that of the grooved ax. In fact some of the notched axes are nothing else than celts notched at the sides, and they are never so large and heavy as are many of the grooved axes.

A type of these axes is shown in Fig. 1, which represents a common form, about one-half the natural size.

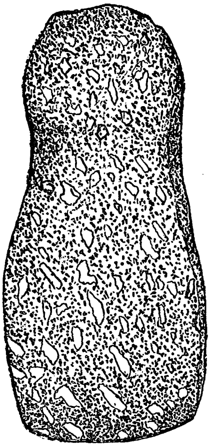

FIG. 1.

As a rule these axes are not more than four or five inches long and two or three wide. They are usually well shaped, neither rude nor clumsy, and the surface is smooth or perhaps polished. The form of some is such as to suggest the adze, and it seems quite likely that an implement so useful in hollowing canoes and performing many of the labors which we know to have been undertaken, was in common use among the prehistoric tribes as it has been for a long time among modern savages, and yet I do not remember that the early writers to whom we always turn for information respecting the customs of our predecessors, say very much of the use of such a tool in their accounts of these people. It is not impossible that some of the implements which we call celts may have done duty as spades, and that some of the ruder "notched axes" may have been, not axes, but hoes. The notches or grooves are always much wider than deep, although the depth varies very greatly in different specimens, but I have never seen it as great as in the grooves of some of the larger grooved axes. The notches are usually about a third of the length below the blunt end of the ax, though in a few cases they are near the middle, as in Fig. 2. These axes group themselves naturally into two classes—those in which the width greatly exceeds the thickness and in which the surfaces are nearly or quite flat, and those in which the breadth and thickness are more nearly equal and in which the surfaces are often convex. Some specimens have one surface quite flat and the opposite convex, just as is often the case in the celts, and it is possible that these were used as skin-dressers or fleshers, and without a handle, the notches serving as convenient places for the fingers as the hand grasped the tool. The specimen shown in Fig. 1 is of dark porphyry and is polished over the whole surface, and is, as indeed are most of these implements, made with care and skill. It is four and a quarter inches long and two inches in greatest width. In Fig. 2 we have quite another form of ax, and one which is not common. It is about four inches long and two and a half inches wide. It is made of trap, and it is noticeable that most of these small axes are made of hard, compact material. I have seen no specimen of the notched ax which, like some of the celts, was sharpened at both ends, but one or two of the latter are drawn in near the middle as if the maker had thought of notching them that a handle might be more firmly attached, and these are almost notched axes, although the notch is so very slight that I have not thought best to include these specimens in the present article.

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[1] Continued from p. 1149, December number, 1885.

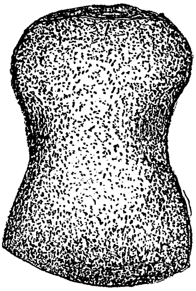

FIG. 2.

With very few exceptions the grooved axes found in Vermont are larger than those we have called notched axes. They are not at all abundant in any part of the State, and in the northern counties they are very rare. It is quite remarkable that in some localities where celts and other implements are especially common, grooved axes have been very seldom found, if at all. As compared with the Southern or Western grooved axes, our Vermont specimens present differences which are sufficiently noticeable when one looks over series of each, but which can not readily be made apparent in words. Our axes are, in size, intermediate, none of them being so small as the little " toy " axes found in other localities, nor are any so large as many that have been found. Neither do we find axes grooved only on three sides, but in all our specimens the groove extends entirely around the ax. In the collection of the University of Vermont there is one specimen, which is doubtfully of Vermont origin, in which the groove is found only on three sides, but in all the rest the groove is completed around the specimen. This is somewhat remarkable, because, according to Dr. Abbott (Primitive Industry, p. 8): " Possibly two-thirds of the stone axes found in New Jersey have the groove extending along the sides and across one margin;" and the same author speaks of " one-half probably of the axes found in Connecticut and northward having the groove entirely encircling the stone," and by inference the other half were not so. Our axes usually have the groove a little above the middle and parallel with the edge. It is never very near the blunt end, as in some of the Western specimens, nor is it ever bordered by a raised lip. Our average specimens are from five to seven inches long and about two-thirds as wide, and weigh two or three pounds, but occasionally they are larger, as is the specimen shown in Fig. 5, which is one of the largest axes I have seen from this region. Some of our grooved axes were evidently made from cobble stones, and in some of these the upper end is left very much in its original condition with its water-worn surface unwrought. The same form seems to have been copied in specimens the entire surface of which is wrought, for although these may show everywhere tool-marks, the form of the head is precisely that of those in which it is the natural water-worn pebble. In general form the Vermont axes are noticeably wider, shorter and thinner than the typical Western specimens, and therefore less clumsy and heavy, even when of the same length. The long, slender axes found in some of the Western localities do not occur in the Champlain valley.

Our grooved axes are not often very rude but, though seldom polished, the surface is generally well picked and smoothed. The edge is, naturally, always polished, but the groove is not in any specimen so completely smoothed that the pits and striæ made by the instruments used in excavating it are obliterated, and in most cases there is little attempt at polishing it. Even when the rest of the surface is smoothed, the groove is not. This is unlike what is common among stone axes from other places, for in these we very often find the groove finely polished.

In Fig. 3 we have represented a specimen of singular form, and in some respects unique.

As the figure shows, the notches are very deep, though the groove is quite shallow, and the form of the head above the groove is unusual. The material of which this ax is made, instead of being of trap or quartzite, or some such hard, compact stone, is quite peculiar in that it is of a red sandrock common along Lake Champlain, and which is not a very suitable material for an ax. As shown in the figure this specimen appears more rude and ill-finished than it was originally, for, either from the effects of weathering or hard usage, the smooth surface which evidently existed at first, has been flaked off in many places, giving a rude appearance.

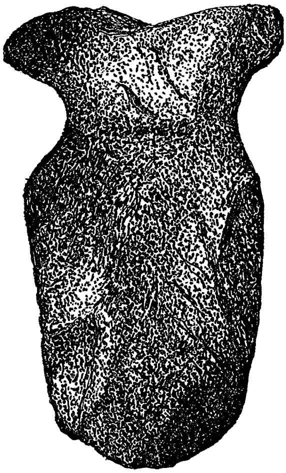

FIG. 3.

This is one of the larger of our axes, the length being eight inches, width across the head four and a half inches, while the general width below the groove is four inches. The special peculiarity of this ax is found in the obliquity of the edge, which is not very well shown in the figure. That portion of the ax below the groove is not worked to the same plane as that above, but is as if twisted spirally so that a line drawn parallel to the edge would cross at a large angle a similar line drawn across the head or parallel with the groove. Nor is this an isolated example. In a fine large ax in our collection, from Springfield, Mass., the same obliquity in the lower part is seen, and in several celts I have seen the same form. So marked is this twist that it would seem impossible to strike a fair blow with such an ax if it was attached to a long handle, and this difficulty raises the question whether some of these large grooved axes may not have been hand axes, not many of them, perhaps, but a few. The head of the Springfield ax is rounded carefully, and indeed the whole ax is very well made, and when held in the hand with the ends of the fingers in the groove, it seems most admirably adapted for use in this way. I am aware that the groove in itself suggests a handle of some sort, but, as has been noticed, in the case of these oblique axes at least, the hand and arm of the user would surely make a much better handle than any other. The form cannot be regarded as accidental, I think; the specimens are too carefully and thoroughly made to allow place for such a supposition.

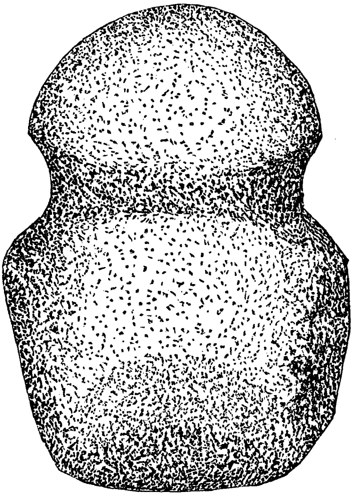

FIG. 4.

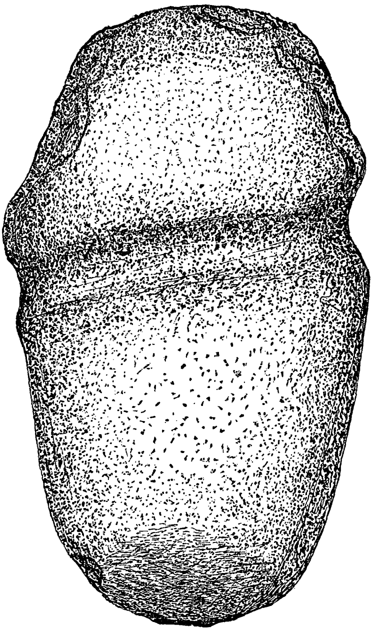

FIG. 5.

The general character of our Vermont grooved axes is very well shown by Figs. 4 and 5, which represent the two classes most often found. Both of them are comparatively quite flat or thin, and our grooved axes never approach a cylindrical form, but are always narrowly elliptical in cross-section. Scarcely any two specimens are alike, but most of them resemble more or less closely one or the other of the forms here figured. The specimen shown (very much reduced in size) in Fig. 4 is a very well made and finished ax, worked out of a syenite cobble-stone, and the upper end apparently still retains the general form of the pebble. It is of average size, being five inches long and three and a half inches wide just below the groove. This specimen illustrates the short and wide form, while the less common and longer form is seen in Fig. 5. This ax is one of the largest specimens, and most, if not all, of this form are large. Some of them are less rude than that figured, which shows the effects of hard usage, though it probably was very well finished at first. It is made of a dark gray grit or hard sandrock, much like that used for making the harder varieties of grindstones. The flat surfaces are rubbed quite smooth, although somewhat pitted. The groove is only moderately deep, but is unusually wide, and is smooth as if worn by long usage, and as the figure shows, it runs obliquely. Both sides are flat, one somewhat more so than the other, and the edge is formed by beveling the surface, mainly from one side. This ax, and the same is true of all of this form, was evidently worked out of a mass taken from a ledge. Not only does the smoothness of the groove show that this implement has been much used, but the edge is chipped and broken somewhat, and the head very considerably battered as if it had done hard duty as a maul. It has been thought by some that these large axes were, some of them at least, used to break holes in the ice in winter for fishing or to get water, and this specimen may have served for some such work. Very few axes so large as this have been found in this State. The figure is somewhat more than one-third natural size. The length is a little over nine inches, and the width above the groove nearly five and a half inches, while just below the groove it is five inches. The specimen weighs four pounds, which is much less than that of some of the Southern specimens. The inequality of the two flat sides, which is sufficient to be quite noticeable in this specimen, is still more marked in some others, and, as in the celts and other forms of the ax, this flattest side is always smoother, sometimes very much so, than the opposite side, a fact for which it does not seem easy to account. In a skin-dresser or hand ax it is quite natural that the side which, from accident or intention, was most nearly flat should be held down upon the skin or whatever the surface that was being worked, and thus become smooth and flat even if not made so at first, but how anything of this sort could take place in a large, hafted ax we are unable to guess, unless it was used as an adze, and this is possible. The oblique direction of the groove seen in this specimen is worthy of notice, since it does not appear to be common in New England specimens. Dr. Abbott (Primitive Industry, p. 8) says that in the valley of the Susquehanna river in Pennsylvania the majority of grooved axes have the groove oblique with reference to the edge, but that this feature is rarely met with in New Jersey and "probably does not occur in New England. There is no example in the large series of New England axes in the museum at Cambridge." Several of our Vermont axes, all I believe from the northern part of the State, have oblique grooves.

I do not think that archæologists have given the grooved ax sufficient credit for utility as a cutting implement. They seem for the most part to be of the opinion that at best these axes could be used only to cut into the bark and bruise the wood so that a fire kindled about a tree so prepared should have greater effect. This may very probably have been a common, perhaps the common, method, and yet the accounts given us by the early explorers of America seem to me to prove that trees were cut, and cut so that they came down, with stone axes. We must always be on our guard against rendering judgment as to the usefulness of a stone implement if we have no other basis for our decision than the results accomplished by it in our unskilled hands. We all know that stone implements that would be wholly useless in civilized hands are yet of very great efficiency in the hands of savages who have learned how to use them. Many of our stone axes do indeed seem quite unfitted for use as cutting tools, and they may be so, but all are not; some are made from very hard stone and have a smooth, regular edge which, although it may not be comparable to that of a modern steel ax, is yet able to cut soft green wood if not that which is harder. To cite in proof of this only a single writer, let me call attention to one or two statements made by Champlain. The earliest edition of the writings of this explorer, which is now at hand, was published in Paris, 1830, a reprint of course of earlier volumes, but sufficient for our purpose. In his account of a journey which he took with a party of Algonkins in 1609, Champlain speaks several times of the stone axes as used to fell trees, and some of these were "gros arbres," and the account shows that the cutting must have been done with somewhat of expedition. His party had iron axes as well as stone, but our author does not compare the two, but calls them all "meschantes." In describing the customary method of camping when enemies were supposed to be near, he tells us that as soon as the Indians had chosen the place for a camp, they immediately began to cut down trees to make a barricade, and he says that they know so well how to do this that in less than two hours they have so strong a defence that five hundred of their enemies would not be able to break into it without great difficulty and loss of life. Then in another passage he speaks of the Iroquois cutting down trees for a similar purpose. Nowhere does he speak of fire as an aid in the process. Indeed in the first case where he tells us of so strong a barricade, he says that they make no fire lest the smoke reveal their presence to their enemies.

From these and similar accounts it seems quite probable, to say the least, that stone axes were used as axes for cutting timber, and with not altogether unsatisfactory results.

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GROSSE'S CLASSIFICATION AND STRUCTURE OF THE BIRD-LICE OR MALLOPHAGA.[1]

ABSTRACT BY PROFESSOR G. MACLOSKIE.

THE Mallophaga, or bird-lice, are wingless insects with incomplete metamorphosis, mandibulate mouth-parts, two or three-segmented thorax, eight to ten abdominal somites. They live on mammals and birds, feeding on their scales, hairs and feathers. The genera which are found on mammals never occur on birds, and *vice versa.* Redi first observed (1688) that there are some lice with haustellate and others with mandibulate mouth-parts. Nitsch (1842) carefully examined them, and Von Giebel (1874) improved on his work.

Nitsch divides them into two chief groups, Philopteridæ and Liotheidæ; the Philopteridæ have filamentous antennæ and no palps; the Liotheidæ have clavate four-jointed antennæ and palps. The Philopteridæ comprise two families: (1) Trichodectes, the

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[1] Beiträge zur Kenntniss der Mallophaga, von Dr. Franz Grosse in Strassburg. Zeitschrift für wissenschaftliche Zoologie, Bd. XLII, pp. 530–558, mit Taf. XVIII (1885).